

**METHOD FOR SERVICING SUBSCRIBERS  
BY UTILIZING VIRTUAL LAN ON ATU-R OF ADSL**

**FIELD OF THE INVENTION**

- 5        The present invention relates to services on the Internet and more particularly to a method for servicing subscriber ends by utilizing virtual LAN on ATU-R of ADSL with improved characteristics.

**BACKGROUND OF THE INVENTION**

- 10        Recently, Internet has known a rapid and a spectacular development, especially the World Wide Web (WWW) portion. In addition to typical e-mail service, it also provides a multimedia service by combining text, pictures, sound, and video. In a sharp contrast to the booming multimedia on Internet, users using conventional dial tone network become more and more unsatisfied with
- 15        28.8, 33.6, or 56 kbps transmission rate available from typical modem. Further, users using local area network (LAN) or integrated subscriber digital network (ISDN) become unsatisfied with current transmission rate available from network. It is also understood that multimedia data transmitted on network is large. Hence, Internet service providers (ISPs) propose many high transmission rate solutions
- 20        for increasing the transmission rate of such multimedia data.

- One of the important solutions is digital subscriber line (DSL). Such DSL is different from typical analog-based plain old telephone service (POTS). DSL has many versions which are collectively called xDSL. In the current DSL systems, asymmetrical digital subscriber line (ADSL) is the most important xDSL. ADSL
- 25        can effect a transmission rate through existing POTS without an expansion of the existing equipment. Specifications related to ADSL have been stipulated. It is envisaged that ADSL based transmission will be widely employed in various

fields and our daily life. Advantages brought by ADSL will not only increase speed and efficiency of information transmission but also facilitate work and bring convenience to daily life.

As to the employment of existing telephone line by ADSL system, an ADSL modem is required. This is similar to using modem to access Internet via typical public switch telephone network (PSTN). The data transmission rate of ADSL is 1.5M bps to 9M bps in downloading and that is 64K bps to 640K bps in uploading depending on type of modem, transmission technique, and transmission distance (as the most important factor). Such difference of transmission speeds (i.e., downloading is about ten times faster than uploading) is the reason why it is called asymmetrical. Media employed by ADSL system is twisted pair wire (TPW) which is widely employed by existing telephone line. Hence, conventional dial tone network may become a high speed digital line having high speed data transmission capability without modifying existing transmission line. As such, it is capable of effecting high speed downloading, median speed duplex transmission, and maintaining the connection of existing telephone line without updating equipment in the exchange of central office 10. Referring to FIG. 1, a network structure of typical ADSL system is shown. Two ADSL modems 30, 40 are installed in central office 10 and subscriber end 20 respectively. This completes an ADSL system 1. ADSL modems 30, 40 can effect a high speed data transmission by employing a bandwidth wider than voice technique. Also, an advanced algorithm is employed to divide a transmission line into three channels as follows:

1. Receiving channel: this is an one way (i.e., from exchange to subscriber end) high speed (i.e., transmission rate is 1.536 Mbps to 6.144 Mbps) channel.

2. Transmission channel: this is a duplex (i.e., from exchange to subscriber end and from subscriber end to exchange at the same time) (or one way in some





- asymmetrical digital subscriber line (ADSL) transmission unit at the customer premises end (ATU-R) of the ADSL. The method comprises utilizing the VLAN to generate a plurality of virtual connections in an ADSL connection; coupling equipment of each subscriber end to a plurality of subscriber input/output (I/O)
- 5 ports in the ATU-R; adding a switching hub in the ATU-R for identifying tagged data in the virtual connections; connecting each subscriber end in the virtual connections to the switching hub via Ethernet; and assigning each subscriber I/O port in the switching hub to one of the virtual connections having a distinct tag. By utilizing this, each virtual circuit may service different subscriber ends,
- 10 ensure no data packet of each subscriber end assigned to other subscriber line on the same ATU-R, and there is no need to worry data to be seen by other subscribers during broadcasting the packet.

- It is another object of the present invention to provide a method for servicing subscriber ends by utilizing a VLAN on an ATU-R of the ADSL. The method
- 15 comprises commanding a switching chip to send the data packet to the specified subscriber end based on an identification of the data packet on the virtual connection; commanding the switching chip to perform an identification based on the received data packet for determination; adding a corresponding VLAN tag on the data packet and the identification associated with the virtual connection
- 20 prior to sending to the CPU; and commanding the CPU to transmit the data packet through the corresponding virtual connection based on the identification of the data packet on the virtual connection. By utilizing this, processing time in the last mile of ADSL system may be reduced, thus increasing the transmission efficiency.
- 25 The above and other objects, features and advantages of the present invention will become apparent from the following detailed description taken with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a network structure of typical ADSL system; and

FIG. 2 is a network structure of an ADSL system according to the invention.

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## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 again, in the conventional ADSL system 1 there are ATU-R 42 and POTS splitter 41 provided in ADSL modem 40 of subscriber end 20. ATU-R 42 and POTS splitter 41 are coupled to ADSL modem 30 in exchange of central office 10 through TPW 50. ADSL modem 30 consists of ADSL transmission unit at the network end (ATU-C) 32 and POTS splitter 31. With this configuration, ADSL modem 40 and ADSL modem 30 can transmit and receive voice data and network packets therebetween.

In general, there is only one LAN port in most ATU-Rs. However, it is impossible of neither servicing multiple subscribers nor distinguishing different subscribers if there are provided many input/output (I/O) ports which are located on the same broadcast domain. Basically, an independent ADSL modem 40 is required to install in subscriber end 20 so that ADSL system may provide desired wide band network service. Further, ATR-U 42 is required to employ a portion of the connection (or called last mile) to connect to ADSL modem 30 in exchange of central office 10. In a few complicated ATU-Rs, there are more than one independent I/O port provided and a routing technique is utilized for servicing multiple subscribers by a single ADSL connection. However, it may increase cost. To the worse, it does not support the current most popular bridging technique, resulting in a less flexibility to central office and subscribers.

Referring to FIG. 2, there is shown a network structure of an ADSL system constructed in accordance with the invention. The invention utilizes a virtual LAN

7

